A New Polyclad Turbellarian Associating with a Hermit Crab in the Hawaiian Islands

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AT THE REQUEST of Dr. Ernst S. Reese of the University of Hawaii the writer has studied seven specimens of a polyclad turbellarian found in the shells of *Trochus sandwichensis* occupied by the hermit crab *Calcinus latens* in Kaneohe Bay, Oahu, Hawaiian Islands. According to Dr. Reese (in litt.) the worm wraps itself around the abdomen of the crab and usually occurs deep in the spiral cavity of the molluscan shell. When dislodged from its shelter and placed in a dish of water together with the crab in its shell, the worm tries to re-enter the shell, but only one case was actually seen of the worm entering. The frequency with which this association occurs is about one per 25–30 crabs, but a particularly high incidence of four worms to 60 crabs was found on March 7, 1967, in the same location in Kaneohe Bay.

Apparently the polyclad has not been found in the shells of other hermit crabs, *Calcinus laevimanus* and *Clibanarius zebra,* associating with *Calcinus latens,* although the three species use *Trochus sandwichensis* shells, and the only ecological difference between them is that *Calcinus latens* extends further down into the sub-tidal than does either of the other two species.

The present specimens undoubtedly belong to the genus *Emprosthopharynx* and appear to represent a new species. They were first noticed by Dr. Reese's research assistant, Mrs. Anne Phillips Rasa, and the writer has much pleasure in naming the species after her.

The writer would like to thank Dr. Reese for giving him the opportunity of examining the worms, and for providing information on their behaviour. The type specimens are deposited in the collections of the British Museum (Natural History).

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Emprosthopharynx rasae sp. nov. (Figs. 1–3)

In life, the worms are light reddish brown to tan, with somewhat paler margins, but when preserved in glycerine-alcohol the body is whitish, with the dorsal surface in mature specimens being faintly mottled with brownish spots which appear to be ovaries lying beneath the wall of the body. The seven specimens available are in varying stages of development. Of the two largest mature specimens, one measures 20 mm in length and 6.5 mm in maximum width, and the other 18 mm long and 7.0 mm wide. The body is elongate oval in outline and tapering somewhat at both ends. It is dorso-ventrally flattened and measures about 1 mm in maximum thickness. No tentacles or indications of them have been made out. The cerebral organ is relatively small and lies in the median line at about 2.5 mm from the anterior margin of the body in the larger specimens.

The eyes, which are not numerous, are very small and mainly submarginal in the anterior region of the body. A few, however, lie in the cerebral area. The submarginal eyes form a band extending posteriorly to a level close behind the cerebral organ. The eyes occurring in the region of the cerebral organ are disposed in four groups (Fig. 2). Two of the groups are located one on either side of the cerebral organ; each consists of a pair of eyes, and these may be regarded as the tentacular eyes. Sometimes the tentacular eyes divide, and therefore three or four eyes may be seen in one group. The other two groups, each containing from three to five eyes arranged more or less in a row in front of the cerebral organ, may be considered as the cerebral groups, which lie more ventrally in the parenchyma than the tentacular eyes.

In a complete specimen stained with Mayer's paracarmine there is a submarginal area around the whole body which stains a deeper hue than the rest of the body wall. From serial sections

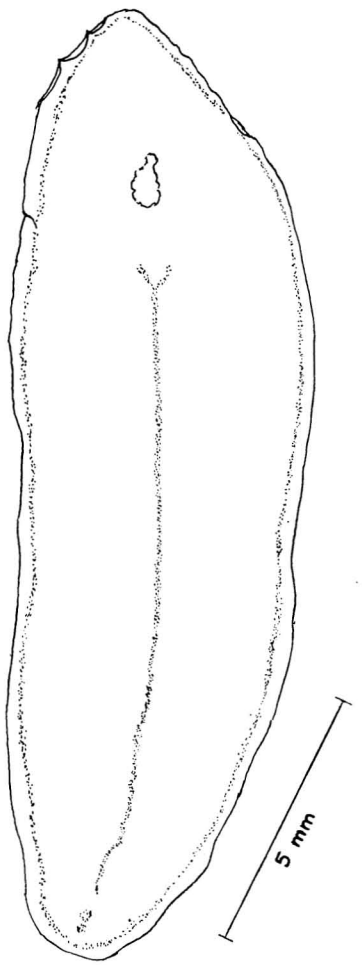

FIG. 1. *Emprosthopharynx rasae.* Ventral view.

it has been ascertained that the differentiation of a submarginal zone is due to the presence of numerous subcuticular gland cells, which open on the ventral surface of the body. These cells appear to contain a material that is deeply stained by eosin, and when secreted onto the ventral surface of the body it probably has adhesive properties.

The mouth opens into the middle region of the pharyngeal chamber, which is very small, measuring only about 0.6 mm in length in the larger specimens. The pharyngeal chamber lies immediately behind the cerebral organ and shows no indication of possessing lateral pockets. It opens into a backward directed intestine, situated in the median line and extending into the hinder region of the body. Throughout its length, the intestinal trunk bears numerous lateral branches which divide but do not appear to anastomose.

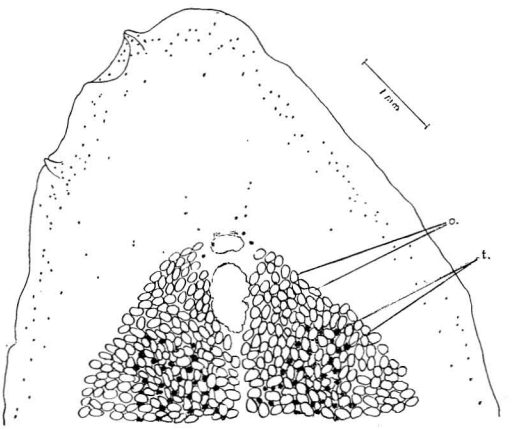

FIG. 2. *Emprosthopharynx rasae.* Anterior region of body, showing arrangement of eyes and distribution of ovaries and testes. *o.,* Ovaries; *t.,* testes.

The male genital pore is situated near the hinder extremity of the body, and the male copulatory complex lies entirely in front of it. The testes are small and follicular, and occur only in the ventral parenchyma, adjacent to the subepidermal musculature. They are distributed in the median and submedian fields from about the level of the pharynx to near the copulatory complex. They open into a common sperm duct which lies in the median line, ventrally to the intestinal trunk. This sperm duct extends from a short distance behind the pharynx into the hinder region of the body. It has thin walls and opens into a seminal vesicle. The latter is elongate, has thick muscular walls, and is lined with a ciliated epithelium. Although sperm is massed in the common sperm duct, none is present in the seminal vesicle. A short ejaculatory duct runs from the seminal vesicle to open into the prostatic organ, which is a little larger than the vesicle. The prostatic organ is pyriform and possesses a thick muscular wall investing a tall glandular epithelial lining. This lining is smooth, as in other members of the genus *Emprosthopharynx.* Passing through the musculature of the prostatic organ and opening into its epithelium, there are several collecting tubes of unicellular glands lying in the surrounding parenchyma. The prostatic organ opens directly

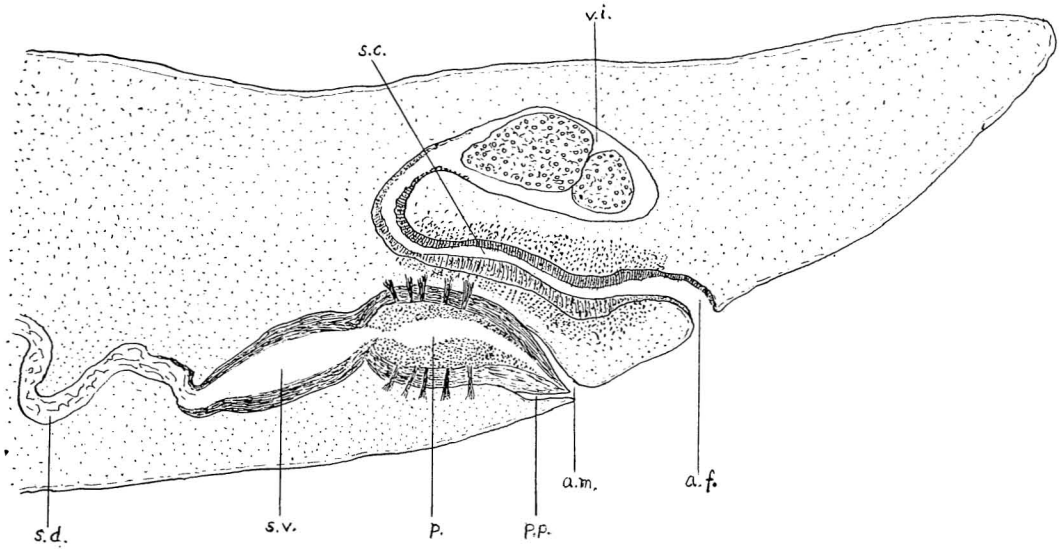

FIG. 3. *Emprosthopharynx rasae.* Sagittal view of copulatory organs. *a.f.,* Antrum femininum; *a.m.,* antrum masculinum; *p.,* prostatic organ; *p.p.,* penis-papilla; *s.c.,* "shell" chamber; *s.d.,* sperm-duct; *s.v.,* seminal vesicle; *v.i.,* vagina interna, containing eggs.

into a relatively stout, conical, penis-papilla, which occupies much of the antrum masculinum.

The ovaries are very much larger and more numerous than the testes. They lie dorsally to the testes and are distributed in the area between the cerebral organ and the copulatory complexes and extend into the submarginal regions of the body, thus having a greater area of distribution than the testes. The female genital pore lies immediately behind the male opening. It opens into a simple vagina, which extends antero-dorsally, but above the male antrum it turns sharply and runs posteriorly for a short distance. The antrum femininum (or vagina externa) is very short, while the "shell" chamber (vagina media) is relatively long, extending to the dorsal curve. The "shell" chamber is lined with a tall glandular epithelium. The "shell" glands are numerous, surrounding the "shell" chamber and forming a pair of ala-like areas extending out from the chamber on both sides. The posteriorly directed portion of the vagina (the vagina interna) is short, and into its inner end open a pair of uterine canals. These canals extend anteriorly on both sides of the seminal canal to the pharyngeal region of the body.

Hitherto, only three species of the genus *Emprosthopharynx* Bock, 1913 have been recorded: *E. opisthoporus* Bock, 1913, from the Galapagos Islands and Panama; *E. vanhoffeni* Bock, 1931, from the Cape Verde Islands and Morocco; and an "extremely minute" and undetermined species of this genus mentioned by Bock (1925:61) from the Gilbert Islands.

The species described here differs from *E. opisthoporus* in possessing fewer cerebral and tentacular eyes, in having an elongate and not a bulbous seminal vesicle, and in the fact that the sperm canal is not bifurcated in the hinder half of the body, as it is in the latter species. *E. vanhoffeni* is clearly very closely related to the present form but may be differentiated principally by its smaller size, by the distribution and greater number of eyes, and by the presence of a penis stylet.

It is interesting to note that the specimens of *E. opisthoporus* recorded from Panama by Bock (1925:61) were found in the "houses" of the pagurid *Petrochirus californiensis* from two different localities. Unfortunately, these specimens were not described morphologically,

but figures of them, in which are shown the number and arrangement of the cerebral eyes, as well as the elongate contour of the seminal vesicle, suggest that the worms are, in these features, more comparable with the present form than with the type specimen of *E. opisthoporus*. It seems possible, therefore, that only one species of *Emprosthopharynx* inhabits the "houses" of pagurids in the eastern Pacific, and that it is different from the free-living form occurring in the Galapagos.

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